



COLONY OF MAURITIUS

DEPARTMENT OF AGRICULTURE

Nineteenth Annual Report
of the
Sugarcane Research Station
1948

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PRINTED AND PUBLISHED BY
J. ELLIOT FELIX, GOVERNMENT PRINTER
PORT LOUIS, MAURITIUS
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SUGARCANE RESEARCH STATION, MAURITIUS

19th ANNUAL REPORT 1948

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RESEARCH ADVISORY COMMITTEE OF THE SUGARCANE RESEARCH STATION FOR THE YEAR 1948

Ex-officio :

The Director of Agriculture—*Chairman*.
 The Chemist.
 The Botanist.
 The Geneticist.

Nominated by His Excellency the Governor :

Mr. G. Park.
 Hon. A. M. Osman, O.B.E.

Nominated by the Advisory Board of the Mauritius College of Agriculture :

Mr. G. P. Langlois.
 Mr. Pierre Halais.

Nominated by the Sugar Industry Reserve Fund Committee :

Mr. Julien Doger de Spéville.
 Mr. Pierre de Sornay, *Chevalier de la Légion d'Honneur*.

Nineteenth Annual Report of the Sugarcane Research Station for the Year 1948

General

The Sugarcane Research Station was established in December 1929, and actually started work as a Station in January 1930, part of the funds for its establishment being provided by a grant from the Empire Marketing Board, part from the Sugar Industry Reserve Fund and part from the Mauritius College of Agriculture. The period since its inception has seen many improvements in the sugar industry of this Colony and it is no exaggeration to say that in some aspects at least the Sugarcane Research Station has played a predominant part.

During the past nine years, from the end of 1939 onwards the Station has, in common with many other research institutes, experienced great difficulties because of shortage of staff, irregular supply of necessary materials and the necessity to undertake work outside its strict province because of the exigencies of the situation caused by World War II. In spite of these difficulties, however, progress has been maintained, though not at the same speed which it is hoped would have been achieved had these difficulties been averted. In particular, during this period, the work of sugarcane breeding has not only been maintained, but its scope has been widened by the establishment of an experiment station in the cool wet uplands.

This period of nineteen years has seen big changes in many ways. In 1930, the chief variety grown was the White Tanna, which occupied about 60 per cent of the area under cane, so that the first object of cane breeding was to obtain a variety superior to it. Before any variety had been released, however, the B.H.10/12 was rapidly extended, at the expense of the White Tanna and other varieties and in 1940, both the White Tanna and B.H.10/12 occupied about 40 per cent of the total cane area each. Since 1940, there has been a spectacular change over in varieties, the like of which has never before been experienced in Mauritius. M.134/32 in 1940 occupied but 2 per cent of the total area, whereas in 1948 it occupied approximately 80 per cent of the total area, with other Sugarcane Research Station varieties occupying about a further 15 per cent. Other ways in which the sugar industry has benefitted as a result of the work of this station are through an improved knowledge of sugarcane soils and nutritional requirements of the sugarcane, and also of modern methods of weed control.

The future status of the Sugarcane Research Station is now at the cross-roads. The Mauritius Economic Commission, which visited the Colony in the latter part of 1947 and earlier part of 1948 recommended that the Sugarcane Research Station should no longer form part of the Department of Agriculture, but that it should be handed over to the sugar industry, to be conducted on similar lines to those in many other countries, e.g., Hawaii, Java, South Africa, etc. This question is still under consideration by the authorities concerned.

Growth Conditions

Rainfall was much below the average during the period under review, but the mere fact that the sugar crop amounted to about 392,000 tons in 1948, compared with the previous record crop of 348,000 tons in 1947, shows that there was no serious shortage of water in general during the critical periods.

Rainfall in November 1947 was short, but in December 1947 it was fairly satisfactory, so that the cane had a fairly good start. During the boom period of growth January to April rainfall was below the average, but was in sufficient quantity to maintain good growth. It has been found in the past that there was no definite correlation between rainfall during these summer months and the final crop, which indicates that the average rainfall is in excess of the sugarcane requirements. That this is so is borne out by the 1948 crop. Following these months, rainfall was generally above normal during the months of July and September and below normal for the remaining months. The rainfall during the months of July and September was probably an important factor, in that it maintained growth and prevented the drying out of the cane later in the year. Conditions were not such, however, as to induce rapid growth, and the maturity of the cane was not adversely affected. For only three months of the year were temperatures below normal, whilst in six they were above normal, four of these being during the winter months of June to October. In these conditions, it is somewhat surprising that the sucrose content of the cane was so high, representing about 12.35 per cent extraction compared with the record in the previous year of 12.45 per cent extraction. This may be accounted for by—

- (a) the small amount of arrowing ;
- (b) the fact that canes did not tend to dry out towards the end of the crop ;
- (c) the erect nature of the canes ;
- (d) the high proportion of M.134/32.

Rainfall figures for three stations representing the dry, intermediate and high rainfall regions are given in the following table, together with temperature data for Réduit. These figures have been supplied by the Statistician of the Department of Agriculture.

Months	Pamplemousses Experiment Station		Central Experiment Station, Reduit		Temper- ature above + or below - Normal °C	Royal College Curepipe	
	Rainfall inches		Rainfall inches			Rainfall inches	
	Normal	Period under consider- ation	Normal	Period under consider- ation		Normal	Period under consider- ation
November 1947 ...	2.13	1.22	2.33	1.64	-0.9	5.71	5.72
December 1947 ...	4.91	3.10	6.37	7.01	0.0	9.71	8.55
January 1948 ...	9.56	3.94	10.32	8.33	+0.2	16.33	11.16
February „ ...	8.74	1.65	10.95	4.63	-0.2	17.28	11.14
March „ ...	9.32	7.23	11.94	8.46	+0.2	19.31	8.62
April „ ...	5.96	7.19	5.41	6.50	0.0	12.39	17.06
May „ ...	4.48	1.27	4.24	0.63	-0.2	9.86	0.85
June „ ...	3.43	1.15	3.11	1.10	+0.4	7.47	3.60
July „ ...	2.93	2.20	2.75	3.57	0.0	8.57	11.96
August „ ...	2.59	0.88	2.47	1.36	+0.2	7.79	5.28
September „ ...	1.83	1.58	1.71	3.07	+0.3	5.78	9.37
October „ ...	1.95	1.48	1.91	1.68	+0.3	4.52	4.42
November „ ...	2.13	1.86	2.33	1.89	0.0	5.71	6.62
December „ ...	4.91	3.27	6.37	3.10	-0.1	9.71	9.27
Normal for one year	57.83	—	63.51	—	—	124.72	—
TOTAL January to December 1948	—	33.70	—	44.32	—	—	99.35

Staff

During the year, a still further depletion of senior staff occurred, in that Dr. H. Evans, Botanist since 1932 and Acting Officer-in-charge since the 1st July, 1947, left the Colony in December on secondment to Trinidad, where he has gone to take up an appointment in the Cocoa Research Scheme. The heartiest good wishes from all his colleagues and many members of the planting community accompany him, and regrets are felt by all at his departure. M. A. de Sornay, who has been Acting Geneticist from the beginning of the year, was confirmed in his post as from the 20th December.

Three candidates have been selected for the vacant posts of Field Demonstrators, and when they have assumed their posts, then the Extension Service for improving yields on small planters' lands will be complete.

Extension Service

The improvement of yields on small planters' lands is regarded as urgent and as a most fruitful line of approach to increasing the total sugar crop of the Colony as quickly as possible. At the present time, it is estimated that the yields obtained by small planters are only about one-half of that obtained by estates. It cannot be expected that their yields will ever reach the same level, as a higher proportion of these lands consists of the less productive soil types, but there is no doubt that much improvement is possible by the

adoption of better cultural and fertilizers practices, particularly the latter. Continued export of mineral plant food in the sugarcane crop, and lack of sufficient applications of phosphatic and potassic fertilizers, particularly, have resulted in a lowering of the level of soil fertility. This lack of fertility has been clearly shown by the results of foliar diagnosis determinations, which has provided a safe basis on which to design demonstration plots. Such plots are the only really satisfactory way to convince many of the small planters of the benefit which they may expect to derive from adopting better methods. The varietal situation with this class of planters is satisfactory, as practically all of them plant the variety M.134/32 to the exclusion of all others.

The Varietal Situation

In general there is very little change in the varietal situation to report. No new varieties have been released during the year. The three varieties M.165/38, M.63/39 and M.76/39, about which doubts have been entertained respecting their quality, have been the object of further study, and planters have been recommended to propagate them slowly, and then only after consultation with the millers. Two new varieties are now under consideration for release, but up to the present, no decision has been taken. The fact that about 80 per cent of the total cane land of the Colony is occupied by one variety, viz., M.134/32 is disquieting, especially in view of the time which would be required to replace it if it became susceptible to some disease.

Field Experiments

A large number of field experiments were harvested during the crop season on estates, and for this purpose the services of the Field Demonstrators had to be utilised. This work will be valuable to them, however, in their future dealings with smaller planters, in that they will have gained experience in field experimentation methods, and also it will permit them to gain basic knowledge regarding fertilizer requirements, etc., in different conditions.

The variety experiments planted include an extensive series calculated to test the following varieties in the different ecological conditions obtaining in the Colony—

B.3337 ; B.3439 ; B.34104 ; B.37161 ; B.37172 ; B.4098 ;

M.213/40 and M.423/41 (two promising S.R.S. varieties ; and

E.1/37 and E.26/42, both of which were bred at Ebène S.E., part of Highlands S.E.

Judging from the results of three experiments with the Barbados seedlings harvested on experimental stations, B.34104, B.37161 and B.37172 appear the more promising.

The series of $3 \times 3 \times 3$ N P K experiments was harvested in second ratoons and are being continued in third ratoons. The results of the 1948 harvestings show that in general there is a big response to the application of 30 kgs. of nitrogen per arpent, but that the yield from the plots receiving 60 kgs. of nitrogen is not much greater on the average than that from the 30 kg. plots.

Responses to phosphates and potash are small and certainly not significant on the average, which indicates the high level of phosphate and potash fertility which has been built up in the past on these estates' fields. It would seem that the optimum content of N, P and K in the leaf punches is somewhat less in ratoons than in virgin canes.

A further series of $3 \times 3 \times 3$ factorial experiments introducing potash, lime and magnesia has been started to test the effect of these three elements upon yield, juice purity and richesse.

The Botanical Division has now harvested the basalt dust trial at Hermitage, and the heaviest application of this dust (182 tons per arpent) has resulted in a significantly higher yield of cane than the plots receiving none, or receiving applications of 91 tons per arpent. In this trial, however, the commercial cane sugar per cent cane shows a progressive drop with the increased quantities of basalt dust. This trial will be continued throughout the whole rotation.

New experiments established during the latter part of the year include experiments to determine the effect of inter-planting sugarcane with various food plants. This work is of importance in view of the necessity of producing as much food as possible, in order to reduce the extent to which the Colony is dependant on outside sources.

Varieties introduced from abroad

No varieties have been introduced during 1948, later than those mentioned in the 1947 Annual Report, viz., C.P.34-120 ; C.P.36-13 ; C.P.36-105, Q.28 and the Hawaiian variety 32-8560. All these have finished their first cycle in the quarantine greenhouse and are now nearing the completion of their second. As soon as they have produced sufficient cane, they will be cut and propagated as quickly as possible at the Central Experiment Station, where they will be kept under observation for a further period.

Export of Cane Planting Material

With the improved conditions of transport by sea and air, a large number of requests for cane cuttings have been received from abroad, and consignments of the better locally bred varieties have been sent to the following countries: Egypt, Madagascar, Réunion, Aden Protectorate, U.S.A., India, Gold Coast, South Africa, Luzon (Philippine) and England.

Conclusion

I would like to express my appreciation of the manner in which all members of the Station have kept the main lines of working going, in spite of the many difficulties encountered. Also, co-operation between the Sugarcane Research Station and other divisions of the Department of Agriculture, and also the members of the planting community in general has been very cordial ; the number of experiments being conducted on estates with and without mills and on small planters' lands shows the extent to which our work is being aided by the planting community. This hearty co-operation can only lead to one result ; further success.

N. CRAIG,
Deputy Director of Agriculture.

PART I—GENETICIST'S DIVISION

Cane Breeding—M./48 Series

Climatic conditions were on the whole very unfavourable for arrowing during the year under review, with the result that the cane flowered generally very little, particularly in the Northern districts of the island. Owing to the sparse and erratic arrowing in both the field and breeding plots, the breeding programme could not be carried out as contemplated, and certain proven crosses have had to be replicated to ensure a sufficiency of seedlings for first-year trials.

Breeding work was carried out at Réduit, Pamplemousses and Hermitage Experiment Stations during the period June–August. The total number of crosses made at these stations was as follows—

				<i>Type of Cross</i>			<i>Totals</i>
				<i>Lantern</i>	<i>Bag</i>	<i>Open</i>	
Réduit	...	...	110	0	25	135	
Pamplemousses	...	...	0	2	0	2	
Hermitage	...	...	8	0	28	36	
TOTALS	...	...	<u>118</u>	<u>2</u>	<u>53</u>	<u>173</u>	

The great majority of the crosses made at Réduit consisted of the usual controlled crosses in the standard single-arrow lanterns. A certain number of open-crosses have had to be made to supplement the controlled crosses, due to shortage of lanterns and also to scarcity of both male and female arrows in the breeding plots, as large a number of crosses as possible being made simultaneously in order to utilise all available arrows. Only two crosses could be made at Pamplemousses, as there was no male breeding plot and the few varieties in the female varieties plot did not flower at all.

Crossing was for the first time carried out at Hermitage Experiment Station, started two years ago. There are no breeding plots at this Station, and canes which flowered in variety trials and propagation plots were used as parent varieties. Very poor results have been obtained as pointed out further.

An interesting feature of the breeding work was the use of new parent varieties, the most interesting of which being the West Indian varieties introduced a few years ago, the variety E.1/37, a local seedling bred by Highlands S.E. and the Sugarcane Research Station recent productions M.213/40 and M.423/41. Five of the Barbados varieties arrowed at Réduit, viz., B.3439 ; B.34104 ; B.37172 ; B.3337 and B.4098 ; the first three were used as females and the last two as males. Over 3,000 seedlings were bred from different crosses with B.3439, B.34104 and B.37172, but none with B.3337 and B.4098. The sixth variety, B.37161 flowered at Hermitage and was used as female. The cane E.1 37 was used in experimental crosses both

as male and female, the results indicating that it is more fertile as female ; when selfed it produced no seedlings. About a dozen crosses were made with M.213/40 as male parent with very satisfactory results. Finally M.423/41, which was used in one cross only owing to scarcity of arrows, produced a large number of fertile seeds.

The cross P.O.J.2878 $\times$ D.109 has been replicated, 10 crosses having been made with the red and white sports of D.109 in the aggregate. The reasons for making a relatively large number of crosses of this type are—

- (1) the famous cane M.134/32 was bred from that cross ;
- (2) fourth-nobilized derivatives of P.O.J.2878 appear promising for Mauritius ;
- (3) the cross generally gives rise to a comparatively small number of seedlings.

The cross M.134/32 $\times$ M.99/34, from which the seedlings M.63/39, M.76/39, M.213/40 and M.423/41 have been obtained, has also been made on a certain scale, with the view to producing a large population of seedlings from which a variety combining both vigour and high sucrose content might be selected. It must be remarked that this cross has a tendency to give rise to high yielders, but with a generally low *richesse*, and it is necessary, therefore, that a large number of seedlings be planted in the field to increase the probability of obtaining a vigorous and rich variety. In that connection it must be kept in mind that the breeding of a new cane does not really mean the production of something new ; it means the reshuffling of considerable number of genetic characters already existent in the genotype. Gene packs are shuffled anew in every reproductive act ; the wider the range of individual differences, the greater the chance of favourable variations and of the production of a superior variety.

It is intended to study the correlation between the weight and Brix of seedlings in populations derived from the above mentioned cross in the subsequent years in order to assess the value of the cross as a potential producer of commercial canes.

A certain number of back-crosses, such as, for example, the crosses: P.O.J.2878 $\times$ M.63/39, P.O.J.2878 $\times$ M.213/40, etc., have been made with the view to producing hybrids richer than these male parent varieties.

The main objects of the breeding work can therefore be summarised as follows—

- (1) the production of fourth-nobilized glagah canes which appear well suited to Mauritius ;
- (2) the building of complex hybrids combining useful commercial characteristics ;
- (3) the breeding of richer hybrids from M.165/38, M.63/39, etc.
- (4) the study of new potential lines.

The germination of the fuzz from the Réduit crosses was generally satisfactory, and a sufficient number of seedlings was raised for large-scale seedling trials at the three experiment stations. Of the two crosses made at Pamplémousses one only produced an insignificant number of seedlings. Fuzz from one cross only germinated at Hermitage, although 36 crosses had been made; the failure may be ascribed to the following main factors—

- (1) most of the male parent varieties used had a high percentage of yellow anthers and therefore produced very little pollen;
- (2) the unfavourable climatic conditions prevailing in the locality;
- (3) the high percentage of open-crosses.

With regard to the low pollen production of the male arrows used at Hermitage, it is worth while recording that, in the case of the variety M.63/39, the percentage of red anthers and amount of pollen produced decrease from the low lying to the elevated regions of the island: this variety is a strong male at Pamplémousses, a male of medium fertility at Réduit and produces little pollen at Hermitage.

Should the same unsatisfactory results be obtained at Hermitage in 1949, it might be decided to discontinue crossing at that station during the following years.

The table below shows the extent of the breeding work, the number of seedlings obtained and the number planted in the field at each experimental station.

Nature of Cross	Number of crosses made	Number of seedlings obtained	Number of seedling planted in the field		
			C. E. S.	P. E. S.	H. E. S.
1. 4th Nobilized <i>S. spontaneum</i>	... 14	512	154	0	189
2. 5th Nobilized <i>S. spontaneum</i>	... 13	4,651	1,209	872	1,232
3. Mixed <i>S. spontaneum</i> crosses	... 78	21,123	5,575	4,745	5,238
4. Crosses involving several <i>Saccharum</i> Species	... 33	2,231	761	321	694
TOTAL	... 138*	28,517	7,699	5,938	7,353

Total planted = 20,990

Very few seedlings having been raised from the crosses made at Pamplémousses and Hermitage, all the seedlings planted in the field at these stations have had to be supplied from Réduit. Those sent to Pamplémousses were transferred in the box stage, and potted out there; those supplied to Hermitage were transported by lorry in the pot stage.

Beds having been constructed at the latter station, it has been possible to investigate the advisability of potting out seedlings direct from the box stage. About 500 seedlings from one cross were potted out and kept on these beds up to the time of transplanting, the usual precautions being taken to prevent wilting after potting. The results obtained are very encouraging: the seedlings have made satisfactory growth and have apparently not suffered a set-back, suggesting that all the seedlings required for transplanting at Hermitage could be potted out there and not transported from Réduit, provided adequate nursery equipment be available.

*One only of the 36 crosses made at Hermitage is included in this table.

Breeding Plots. Breeding plots of male and female varieties have been planted at Réduit. The old breeding plots have been kept in case the newly laid down plots fail to produce a sufficient number of arrows for breeding purposes in 1949. A plot of male varieties was planted at Pamplémousses and the number of female varieties increased so that crossing may be resumed on a normal scale to supply all the seedlings required for planting at that station.

First Year Trials

(i) *Virgins—M./48 Series.* Field plantations of the 1948 seedling populations could be completed at the end of December despite the prevailing dry conditions, irrigation water being available at all three stations. At Hermitage Experiment Station a selection was carried out in the pot stage prior to transplanting, all weaklings being discarded but kept in the nursery to supply gaps, should any occur later. It is hoped that seedlings planted at Hermitage could have a satisfactory start if the following conditions could be fulfilled—

- (a) planting all the seedlings in November ;
- (b) an adequacy of water supply for hand-watering the seedlings, or for irrigation if a reservoir were to be constructed ;
- (c) planting only the well developed seedlings and rejecting all weaklings ;
- (d) efficient methods of borer control.

Spacing Trials. These trials have, for the first time, been laid down at the experimental stations, the object being to determine the best planting distance to eliminate or reduce border effect between adjacent seedlings to the greatest possible extent. All the rows are $4\frac{1}{2}$ feet apart, and the distance between consecutive seedlings in the rows are 3 feet and $3\frac{1}{2}$ feet respectively, as against the normal planting distance of $2\frac{1}{2}$ feet. Experiments will be carried out whereby the magnitude of the border effect will be assessed, but it is hoped that much information will be obtained from periodical inspections of the seedling populations regarding the extent to which poaching takes place.

(ii) *Virgins—M./47 Series.* The favourable climatic conditions experienced during the growing season have rendered possible the selection of seedlings from the virgin populations at Réduit and Pamplémousses. Selection was carried out in November at both stations, and 201 seedlings were selected from a population of 15,000, or approximately 1.4 per cent, and planted in propagation plots prior to testing in second trials. The seedlings at Hermitage could not be selected, being too backward ; selection will be carried out in 1949.

(iii) *Virgins—M./46 Series.* The seedlings at Hermitage were selected in September and 67 seedlings chosen. Expressing this figure as a percentage of the total population would be meaningless in view of the high percentage of dead seedlings which had been replaced by germinated cuttings of M.134/32 to avoid gappy stands. There is nothing of particular importance to report except that the Brix of all seedlings examined was much lower than that of those at Réduit and Pamplémousses ; this was to be expected in view of the unfavourable climatic conditions prevailing in this locality. The population was uprooted and not grown in ratoon as usual.

(iv) *Ratoons—M.46 Series.* Selection from the ratoon populations was carried out in August at Pamplémousses and in September at Réduit, and 228 seedlings selected out of a population of 13,000, or about 1·7 per cent, for further observations.

Research work on seedling selections in the ratoon stage was pursued. The randomised blocks (progeny tests) laid out for testing the relative merit of various crosses made in 1947 have been harvested at Réduit and Pamplémousses but the results will be discussed in a separate publication.

Propagation Plots of Selected Seedlings

All seedlings selected from virgin and ratoon populations have, as usual, been planted in propagation plots. It is considered of primary importance that as large a number of seedlings as possible be selected and tested in these plots. In an investigation carried out in 1943, the writer emphasized the necessity of lowering selection standards and picking out a high percentage of seedlings from the first-year populations for subsequent trials, the main reasons in favour of this contention being: (*a*) non-replication in the seedling trials, and the consequent large error attached to the stool weight, (*b*) interaction between adjacent seedlings in a row. The object in view is to start from the very early stages of the breeding work with as many selections as possible, in order to increase the chances of selecting a superior variety should there be one among those under trial.

A new method has been used for laying down the propagation plots: each seedling is replicated twice and there are two to three rows of the standard variety (M.134/32) per block, depending on the number of varieties being tested, the seedlings being at random in the blocks. If the most promising varieties in the plots could be analysed for sucrose at harvest instead of determining their Brix a great step forward would be made.

Second Year Trials

(i) *Trials laid down.* Twenty-four trials have been laid down during the year, 8 at Pamplémousses and 16 at Hermitage. None was planted at Réduit, the selections from the propagation plots being all transferred to Hermitage, one of the reasons for the transfer being the urgent need of finding a suitable variety for localities displaying the type of climate prevailing in that region.

The trials at Pamplémousses comprise selections of the M./45 and M./46 series, and those at Hermitage the M./44 series (ratoon selections).

One trial with 3-row plots and one with 4-row plots have been laid out at Pamplémousses. Although such methods of lay-out are rather extravagant of space, the results should be more trustworthy owing to the larger size of each individual plot as compared with the 2-row plots.

(ii) *Trials harvested.* Thirty-six trials have been harvested, 17 in virgins and 19 in ratoons. The results of 8 trials reaped in first-ratoon at Réduit are illuminating: out of a total of 47 seedlings under trial only one seedling was selected, and two which had been selected in virgins were re-selected,

in ratoon. These results show that it is imperative to harvest the second trials in ratoons as well as in virgins, so that the ratooning qualities of the seedlings may be gauged, one of the main problems confronting the cane breeder nowadays being the production of a cane capable of competing with the standard variety, M.134/32, which possesses a strong ratooning power under adequate cultivation conditions.

At Pamplémousses out of 39 seedlings under trial, 3 selections were made in ratoons, and 4 virgin selections re-selected in ratoons.

A certain number of seedlings have been provisionally selected from the trials cut in virgins, but will not be planted in propagation plots before the results of the ratoons are available.

Third Year Trials

(i) *Trials laid down.* Only one trial was laid down at Pamplémousses to test 7 seedlings of the M./43 series against M.134/32.

(ii) *Trials harvested.* Eleven trials have been harvested during the crop, 4 at Réduit, 5 at Pamplémousses and 2 at Hermitage. Seven of the trials were in virgins and four in ratoon.

The following seedlings have been selected in ratoon at Pamplémousses, and planted in propagation plots, due consideration being also given to the results in virgins: M.231/41, M.244/41, M.400/41, M.429/41, M.448/41, M.11/42 and M.22/42. The varieties M.163/42, M.166/42, M.167/42 and M.11/43 have been provisionally selected in virgins and multiplied.

Four selections have been made in virgins from one trial at Hermitage, viz., M.296/41, M.354/41, M.377/41 and M.383/41, and planted in multiplication plots. The most interesting of these varieties is M.383/41 which has considerably outyielded M.134/32 but, unfortunately, it appears susceptible to Red Rot. A few seedlings from other trials have been provisionally selected pending the ratoons results in 1949.

In the case of third-trial 73 reaped in ratoons at Réduit, not a single seedling was selected and the trial was uprooted; a few virgin selections were made from other trials but none multiplied.

The future policy with regard to the results of third trials will be to select provisionally in virgins and not to propagate the selected seedlings until the trials will have been harvested in ratoons, for reasons already put forward.

Variety Trials

(i) *Trials laid down.* Thirty trials have been laid down on estates in 1948 to test various varieties in comparison with the standard variety M./134/32. The Barbados varieties have been included in 17 of these trials, the Sugarcane Research Station varieties M.213/40 and M.423/41 in 14, the Ebene varieties E.1/37 and E.26/42 in 8 and 3 respectively. A few selections from third trials have, in addition, been included in some of the trials.

The trials containing the Barbados varieties include all or a few of the six varieties imported from Barbados, viz., B.3337, B.3439, B.34104, B.37161, B.37172 and B.4098, the number of varieties planted in each trial depending on the amount of planting material available, suitability to climatic conditions, etc. The trials containing these varieties and the local canes M.213/40 and M.423/41 have been laid down in various localities under varying environmental conditions typical of the main ecological areas of the island.

A factorial experiment was laid out at Bénarès S.E., to test the responses of the varieties M.213/40 and M.423/41 to normal and high dressings of Nitrogen.

(ii) *Trials harvested.* Twenty variety trials have been harvested during the crop season, 13 in virgins and 7 in ratoons. Owing to economy of space in this report, it is not possible to present the results of the individual trials, and only those of the trials including the Barbados varieties and the most promising canes bred by the Sugarcane Research Station, M.213/40 and M.423/41, will be dealt with at some length.

(a) *Trials containing the Barbados varieties.* Variety trials containing the six Barbados varieties laid down at Réduit, Pamplémousses and Hermitage in 1947, have been cut during the period October–November 1948. All four blocks of the Hermitage trial have been cut on the same day; one block of the Pamplémousses trial has been cut in October to supply planting material required for planting other trials, and the other three blocks about a month later; the blocks of the trial at Réduit have been reaped at approximately weekly intervals. Samples of 5 canes have been taken from each plot for analysis, instead of the used composite samples of 12 canes.

The results obtained with these trials are the following—

Trial 192—Hermitage (Virgins—not irrigated).

B.3337 was the only variety giving significantly larger yields of cane and sugar than M.134/32; there was no significant difference between the other varieties and the standard.

Trial 193—Réduit (Virgins—irrigated for a period of 2 months after planting and 1 month before harvesting).

No varieties were superior to M.134/32; B.3337, B.34104 and B.4098 were significantly inferior to the standard with regard to yield of sugar per arpent and B.3439 was inferior with regard to both yield of cane and sugar per arpent.

Trial 194—Pamplémousses (Virgins—normal and regular irrigation).

B. 34104, B.37161 and B.37172 gave significantly larger yields of cane and sugar than M.134/32; B.3337 and B.4098 were better with regard to yield of cane only; there was no significant difference between B.3439 and the standard.

The results of these trials in conjunction with field observations made on other trials, laid down since the beginning of 1948, indicate that, on the whole, the best of the six B. varieties appear to be B.37161, B.37172 and B.34104. B.4098 is apparently susceptible to Red Rot and produces a large number of distorted internodes. B.3439 does not appear suitable to our conditions in general and B.3337 does not call for special comments.

Apart from the above results, it should be mentioned that there has been a great variability in the C.C.S. value of the five-stalk samples taken from each plot for analysis. A preliminary investigation was therefore carried out to determine the accuracy of the analytical data obtained from individual samples, the results being discussed later.

(b) *Trials containing M.213/40 and M.423/41.* The results of these trials bear out those obtained the previous year, and show that both varieties have given considerably larger yields of cane and sugar than the standard variety M.134/32.

The results of a large number of trials harvested in virgins and ratoons during the period 1945-1948 are given below—

Varieties	Cane per arpent (Metric Tons)	Juice Purity %	Fibre % cane	Sucrose % cane	C.C.S. % cane	C.C.S. per arpent (Metric Tons)
*M.213/40	44.9	82.2	11.3	14.70	12.3	5.51
*M.134/32	35.8	83.4	11.5	15.03	12.7	4.47
Difference with M.134/32	+ 9.1	- 1.2	- 0.2	- 0.33	- 0.4	+ 1.04
Difference %	25.4	1.4	1.7	2.20	3.2	23.20
†M.432/41	40.9	84.6	11.0	15.48	13.4	5.53
†M.134/32	35.1	83.9	10.2	16.15	14.0	4.80
Difference with M.134/32	+ 5.8	+ 0.7	+ 0.8	- 0.67	- 0.6	+ 0.73
Difference %	16.5	0.8	7.8	4.10	4.3	15.20

Yield of Cane. M.213/40 was significantly superior to M.134/32 in 18 trials and equal to M.134/32 in 7 trials out of 25. M.423/41 was significantly superior to M.134/32 in 8 trials and equal to M.134/32 in 5 trials out of 13.

Yield of Sugar. M.213/40 was significantly superior to M.134/32 in 14 trials and equal to M.134/32 in 9 trials out of 23. M.423/41 was significantly superior to M.134/32 in 5 trials and equal to M.134/32 in 6 trials out of 11.

M.213/40 and M.423/41 are derived from the cross M.134/32 × M.99/34 ; the former was selected from virgin seedling populations and the latter from ratoons. They are, generally speaking, very similar to each other and to M.134/32. M.213/40 has a tendency to arrow earlier and more properly than M.134/32 while M.423/41 arrows much less. More information is required before their resistance to drought can be gauged, but preliminary field

*Means of 23-25 trials

†Means of 11-13 trials

observations tend to indicate that they are resistant, particularly M.423/41. They germinate well, and the shoots cover the ground rapidly, thus reducing weeding costs. They are resistant to gumming disease, but have shown symptoms of chlorotic streak in the gumming trials at Réduit ; no Red Rot has been observed whilst harvesting variety trials. Both varieties seem to show a wide range of adaptations to varying conditions of soil and climate.

Their release for commercial growing is under consideration, and pending a decision, propagation plots have been planted on many estates distributed over the whole island. Ample material for factory tests will be available from these plots next crushing season ; these tests could be made to obtain more precise analytical data of their factory qualities.

Other Investigations

1. *Maturity Testing.* Tests have been performed at Réduit on virgin canes of M.165/38, M.63/39, M.76/39 and M.134/32. A composite sample of 12 canes of each variety was taken at fortnightly intervals during the period August—November and analysed. The figures obtained are too erratic to allow of conclusions being drawn with regard to maturity trends in these varieties, maturity gradients, if any, being completely masked by sampling errors. The results suggest therefore that the size of the samples should be increased, or that several samples of each variety be taken, in order to obtain reliable information.

2. *Control of Arrowing.* Experiments have been conducted to induce and control arrowing in B.H.10/12, the object being to obtain arrows of this variety for crossing with high-yielding varieties, and breeding richer agrotypes. This variety is very rich, but seldom arrows in Mauritius, and has now practically gone out of cultivation. It has been used as a parent variety in the past, but the arrows have had to be transported sometimes over long distances for use at Réduit and Pamplémousses.

The first series of experiments were begun in March 1948, but gave negative results, and will therefore not be described in this report. The second series was started in December ; B.H.10/12 layers were made at Réduit and the rooted canes transferred to the bottom of deep trenches in batches of 3. The batches will be exposed to 2, 3, 4, 5, 6, 7 and 8 hours daylight respectively and one batch will be kept as control. The results, if positive, will be discussed in a subsequent report.

3. *Pollen Storage.* Experiments have been conducted to store sugarcane pollen in a viable condition for export to South Africa. Three methods have been used—

- (a) storing the pollen in anthers kept in tubes at room temperature and in ice ;
- (b) storing whole arrows at room temperature in a saturated atmosphere under bell-jars ;
- (c) storing the pollen itself in vials at room temperature and in a refrigerator at 4°C.

The fertility of the pollen was tested at the end of periods of 7 and 10 days by germination on artificial culture medium composed of agar agar and sucrose.

The first two series of experiments gave negative results, the main cause of failure being the invasion of the anthers by fungal mycelium, which prevented their dehiscence. Preserving the pollen itself at low temperatures has met with a little success, and the method appears the only practicable one. It is intended to repeat the experiment on a larger scale during the 1949 arrowing season.

4. *Brix Variability in Second-Trials.* The results of second trials are not analysed statistically, and an investigation was therefore carried out to assess the magnitude of the average significant difference between varietal means in such trials.

From an area equivalent to that of an ordinary second trial, but under one variety, M.134/32, Brix samples were taken with the Zeiss hand refractometer in the usual way. The lay out allowed of 10 means being calculated, and the significant difference between the Brix of any two means was calculated by the Analysis of Variance.

The results of five experiments carried out on different estates in various ecological areas are the following—

Experiment No.	Variety	Category	Brix Significant difference between any two means	% of General Mean	Remarks
1 ...	M. 134/32	Virgins ...	± 0.49	2.1	Irrigated
2 ...	"	Virgins ...	± 0.82	3.8	"
3 ...	"	1st Ratoons ...	± 0.88	4.1	"
4 ...	"	Virgins ...	± 0.45	2.0	"
5 ...	"	1st Ratoons ...	± 0.63	3.0	Not Irrigated
AVERAGE			± 0.65		

The conclusions to be drawn from the above figures are—

- (i) that the method of sampling normally adopted is sound ; and
- (ii) that a significant difference between the Brix of any two varietal means ranging from 0.5 to 1.0 is to be expected in second trials, assuming that the Brix variability is of the same order of magnitude in other varieties. These results are, however, preliminary, and further investigations are necessary before reliable figures can be obtained for use in the selection work.

5. *Sampling Methods.* The object of this investigation was to determine any variation in the C.C.S. value of a sample of 12 canes, taken at random from a variety trial, due to errors in sampling the juice and bagasse for

analysis. Two samples of 12 canes of M.134/32 were taken and shredded at Réduit and 6 juice and 6 bagasse samples analysed separately per cane sample. The results of the experiment indicate that although the C.C.S. per cent cane of the 12-stalk samples, as determined by the usual analytical methods, is fairly accurate, there is still room for improvement.

6. *Use of the "Standard Error of a Product" Formula.* It is customary to calculate the significant difference between varietal means in trials in tons of C.C.S. per arpent, by calculating the significant difference in tons of cane per arpent and multiplying the figure by the weighted mean C.C.S. per cent cane. This method, although accurate when the results of many trials are taken together, does not allow for the error of the sample itself, and may break down in individual cases.

Advantage was taken of the fact that in the case of Trial 192 harvested at Hermitage, samples of 5 canes had been taken per plot of each variety instead of the usual composite samples of 12 canes, and that the error of the C.C.S. per cent cane could be worked out. The results of the trial in C.C.S. per arpent were therefore calculated by two methods—

(i) from the actual data ; and

(ii) from the standard error of a product formula. A significant difference of 0.3 ton of C.C.S. per arpent was obtained by the first method, and 0.7 ton by the second. The great difference between the two figures may, in all probability, be ascribed to the great variability in the C.C.S. per cent cane figures obtained for the different samples.

Export of Cane and Fuzz

Cuttings of several cane varieties have been exported by air or by sea to the following countries: Egypt, Madagascar, Réunion, Aden Protectorate, U.S.A., India, Gold Coast, South Africa and Luzon (Philippine). A few cuttings of M.134/32 and M.63/39 were, in addition, despatched by air, at intervals of three months, to England, for the London Exhibition to be held in 1949.

Fuzz from three crosses made during the crossing season was exported by air to Egypt. Half of the fuzz from these crosses was sown in the greenhouse at Réduit, and germinated very satisfactorily.

Imported Varieties

The following varieties imported from abroad were transplanted in the quarantine greenhouse at Réduit at the beginning of the year: the Canal Point varieties C.P.34-120, C.P.36-13 and C.P.36-105, the Queensland Q.28 and the Hawaiian cane 32-8560. Tests have been performed by the Plant Pathologist of the Department of Agriculture to detect the presence of Mosaic disease, with negative results. The second generation was multiplied in the greenhouse in September, and planting material for propagation in the field will be available early in 1949.

Notes on Other Work

At the exhibition held in October at the Curepipe Town Hall, the Division staged a well attended exhibit, illustrating various stages of the breeding work.

The writer delivered lectures in Pure Mathematics, Mechanics and Elementary Statistics to the students of the College of Agriculture.

Factory tests have been performed on the recently released varieties M.165/38, M.63/39 and M.76/39 by the Sugar Technologist of the Department of Agriculture, and the results of his investigations will be published in the Annual Report of the Department of Agriculture to which the reader is referred.

Acknowledgements

In conclusion, the writer should like to put on record his appreciation of the whole-hearted co-operation of the planting community, of officers of the other divisions of the Department of Agriculture ; and last but not least, of the loyal support he has received from Mr. G. Mazery, Senior Field Demonstrator, without whose help it would have been impossible to carry out the breeding work efficiently.

A. DE SORNAY,

Geneticist.

PART II—CHEMICAL DIVISION

This Division remained without staff until April, when the Assistant Chemist was appointed.

The main line of work has been, for some years, a comprehensive series of factorial experiments with the object of collecting data so as to render the foliar diagnosis technique more precise and definite with regard to Nitrogen, Phosphate and Potash fertilization. Investigations in this direction have proved to be of real value ; every effort was therefore made by the Station for the maintenance of this series of experiments during a period of nearly 14 months when this division was without staff.

On his appointment, the Assistant Chemist had to cope with a great deal of analytical work for the previous year, in addition to that which was necessary for the current year. He was also responsible for the analytical work of the Botanical Division.

In addition to this, a new series of factorial experiments with Lime, Magnesia and Potash was started, and a few long term experiments at the Central Experiment Station were cared for.

Other lines of research had been contemplated, especially concerning the use of basalt and trachyte as fertilizers or amendments, but the time factor prevented anything in this direction being done during the year under review. This work is being started.

Fertilizer Trials on Estates

Out of 17 now existing $3N \times 3P \times 3K$ trials controlled by the Station, the results of only one were lost through the estate harvesting the trial by mistake.

Of the 16 trials harvested, 14 were 2nd ratoon trials and 2, 3rd ratoon trials. The quantities of fertilizers applied were the same as in the previous ratoons, and are given below in kgs. per arpent.

		0	1	2
N	...	—	30	60
P_2O_5	...	—	25	50
K_2O	...	—	30	60

The tabulated results are presented in Table I, together with the corresponding index of Vegetative Growth.

TABLE I

TABULATED RESULTS OF FACTORIAL FERTILIZER TRIALS ON ESTATES, 1948

Locality	Category	Comparative Yield of Millable Cane										Index of Vegetative Growth													
		Nitrogen					Phosphoric Acid					Nitrogen				Phosphoric Acid									
		0N		1N	2N	0P	1P	2P	0K	(a)	1K	2K	0N	(b)	1N	2N	0P	(b)	1P	2P	0K	(b)	1K	2K	
		(a)	(b)																						
Solitude	... 3rd Ratons	100	(16.3)	184	201	100	(26.0)	100	103	97	89	100	(62.4)	124	127	100	(731)	102	98	100	(730)	100	101		
Bon Espoir	... do.	100	(12.7)	139	152	100	(16.3)	105	99	100	(15.9)	101	103	100	(64.3)	116	117	100	(702)	102	103	100	(698)	103	104
Briançonnais*	... 2nd Ratons	100	(35.7)	99	104	100	(34.7)	110	103	100	(36.2)	99	101	100	(822)	110	111	100	(856)	103	105	100	(869)	101	102
Bénarès	... do.	100	(26.7)	151	148	100	(34.8)	102	103	100	(34.4)	105	105	100	(716)	128	137	100	(868)	100	101	100	(870)	100	100
Savina	... do.	100	(25.0)	115	110	100	(28.2)	90	98	100	(25.6)	108	109	100	(840)	103	108	100	(876)	99	100	100	(879)	99	99
Richelieu-Eau	... do.	100	(23.4)	168	156	100	(33.7)	97	98	100	(32.6)	103	102	100	(656)	119	126	100	(748)	102	101	100	(725)	104	108
Beau Vallon	... do.	100	(18.0)	137	168	100	(24.1)	105	97	100	(22.8)	107	113	100	(607)	122	135	100	(710)	103	101	100	(714)	102	101
Union Flacq	... do.	100	(27.1)	139	141	100	(32.8)	105	109	100	(33.5)	100	108	100	(683)	124	129	100	(788)	103	104	100	(770)	106	108
Savannah	... do.	100	(22.3)	141	154	100	(29.4)	101	98	100	(29.4)	99	101	100	(601)	118	129	100	(712)	103	101	100	(774)	99	98
Mont Choisy	... do.	100	(15.5)	140	148	100	(20.4)	101	93	100	(20.3)	96	100	100	(624)	120	128	100	(778)	102	100	100	(784)	99	99
Pierrefonds	... do.	100	(26.9)	134	161	100	(34.7)	102	103	100	(34.6)	104	103	100	(741)	114	127	100	(844)	98	102	100	(825)	104	103
Rose Belle	... do.	100	(28.6)	109	117	100	(28.1)	113	119	100	(29.0)	112	108	100	(752)	109	112	100	(767)	105	110	100	(767)	106	109
Deep River	... do.	100	(27.3)	107	110	100	(29.2)	95	101	100	(29.0)	99	100	100	(742)	107	110	100	(775)	102	102	100	(771)	102	104
Henrietta	... do.	100	(14.4)	207	233	100	(25.0)	101	110	100	(25.0)	100	104	100	(631)	125	131	100	(760)	98	98	100	(731)	103	105
Beau Champ	... do.	100	(27.7)	132	143	100	(34.9)	98	100	100	(35.2)	92	104	100	(684)	120	130	100	(797)	99	102	100	(785)	102	104
Constance	... do.	100	(26.2)	113	112	100	(29.4)	87	102	100	(27.4)	108	103	100	(824)	114	116	100	(900)	104	98	100	(887)	103	103
General Average (c)	...	22.6	30.9	32.7	28.9	29.1	29.6	28.7	29.3	29.6	100	102	103	100	118	124	100	102	102	100	102	102	100	102	103
Comparative yield (c)	...	100	137	145	100	101	102	100	102	103	100	102	103	100	100	102	100	102	100	100	102	100	100	102	103

(a) Actual yield in tons cane per arpent, represented by 100, is given in brackets.

(b) Actual weight of 30 leaves of 3rd rank, represented by 100, is given in brackets.

(c) The average figures for Nitrogen do not include those of the estate marked with an asterisk, as this trial received, by mistake, a supplementary uniform application of Nitrogen.

It will be noted from previous reports of this Station, that the response to Nitrogen has been constantly increasing since the Virgins.

Of these trials, six were planted without pen manure, whereas the others received, on the average, about 6 tons of pen manure per arpent. To show the residual effect of pen manure, it is necessary to leave out the trial which received a supplementary application of Nitrogen, and the 2 trials in 3rd ratoons, from which the response can be expected to be higher than in 2nd ratoon trials, and to take only the 13 trials of the same category, which are consequently comparable.

		<i>Comparative Yield</i>		
		0N	1N	2N
With pen manure	...	100	124	131
Without pen manure	...	100	152	162

The response to Phosphate and Potash is not yet very pronounced, though it is expected that an appreciable amount of response will be obtained in older ratoons. This will denote the extent to which the different cane soils of Mauritius can do without such or such other fertilizer.

The results of the statistical analysis showing the main effects and interactions between major elements from this series of trials are given in Table II.

TABLE II
RESULTS OF STATISTICAL ANALYSIS OF THE FERTILIZER TRIALS

Category and Locality of Trial	Linear Response				Curvature				Interaction				Standard Error % Mean
	N	P	K	Sig. Diff. 20:1	N	P	K	Sig. Diff. 20:1	NP	NK	PK	Sig. Diff. 20:1	
3rd Ratons :													
Solitude ...	+16.5*	+0.9	-3.1	±5.3	-10.9*	+0.6	-1.8	±9.2	+0.1	-0.8	-5.0	±6.4	20.0
Bon Espoir ...	+6.6*	-0.1	+0.4	±2.3	-3.3	-1.7	-2.8	±3.9	+0.9	-0.9	+1.1	±2.8	13.7
2nd Ratons :													
Britannia ...	+1.6	+0.9	+0.3	±3.3	+2.1	-5.6	+1.2	±5.7	-2.6	+3.6	+2.9	±4.0	9.1
Benares ...	+12.8*	+1.2	+1.6	±3.3	-14.1*	-0.5	-1.6	±5.7	-1.8	+0.0	+0.5	±4.1	9.4
Savinia ...	+2.5	-0.5	+2.4	±3.3	-4.9	+5.0	-2.0	±5.7	+6.6*	-0.5	+1.0	±4.0	12.1
Riche en Eau ...	+13.1*	-0.8	+0.6	±2.0	-20.7*	+1.4	-1.2	±3.4	-0.7	-5.6*	+2.7	±2.4	5.9
Beau Vallon ...	+12.3*	+3.0	+2.9	±4.1	-0.8	-3.4	-0.2	±7.1	-0.5	+2.9	+3.1	±5.0	16.8
Union Flacq ...	+11.2*	+3.0	+2.8	±4.1	-10.1*	-0.7	+3.0	±7.0	-2.7	-1.2	+1.5	±5.0	11.8
Savannah ...	+12.1*	-0.5	+0.2	±4.2	-6.1	-1.2	+1.1	±7.3	+0.4	+1.9	+0.9	±5.2	14.4
Mont Choisy ...	+7.4*	-1.4	+0.1	±1.7	-4.9*	-2.1	-2.0	±3.0	+0.5	+0.1	+2.3*	±2.1	8.5
Pierrefonds ...	+16.3*	+1.2	+1.0	±4.0	-2.8	-0.4	-1.8	±7.0	-1.6	+5.0*	+2.1	±4.9	11.4
Rose Belle ...	+4.8*	+5.2*	+2.4	±4.2	-0.2	-2.1	-4.9	±7.2	+0.6	+2.0	-0.4	±5.1	13.4
Deep River ...	+2.7	+0.4	+0.0	±4.3	-1.2	+3.6	+0.8	±7.4	-2.5	+2.1	-1.3	±5.2	14.9
Henrietta ...	+19.2*	+2.4	+1.1	±3.2	-11.7*	+1.8	-2.3	±5.5	+1.0	+1.7	+1.2	±3.9	12.3
Beau Champ...	+12.1*	+0.0	+1.3	±4.8	-5.7	+1.3	+6.9	±8.3	+2.8	-4.1	-5.7	±5.8	13.8
Constance ...	+3.1*	+0.7	+0.7	±2.8	-3.9	+8.5*	-3.4	±4.9	-0.4	-3.0	+0.5	±3.5	10.0
GENERAL AVERAGE ...	+9.65	+0.74	+0.92	—	-6.2	+0.28	-0.69	—	+0.0	+0.2	+0.46	—	12.34

* Significant.

(1) Linear Response is the difference in yield between the double dose and the zero dose.

(2) Curvature is the difference in yield between the double dose and medium dose minus the difference between the medium dose and the zero dose.

(3) The Interactions are only of the first order, i.e., between each pair of nutrients applied.

Again it will be seen that the main response to Nitrogen is always positive and greater in 2nd ratoons than in the previous crops.

The number of negative responses to Phosphate is decreasing rapidly from 13 in virgins to 6 in 2nd ratoons.

At Rose Belle, there is, this year, a significant positive response to Phosphate application ; the average response to Phosphate for the three crops considered together, is also significant.

No significant response to Potash is found this year (figures for Alma S.E. which always gave a high response to Potash, are lacking), though 5 trials show a response to K_2O when the three crops are taken collectively.

Most of the trials show negative curvatures for Nitrogen, many of which are significant.

On the whole, these trials do not show any appreciable interaction between N,P,K. though it is worth mentioning, for subsequent investigation, the case of Riche-en-Eau, where for 3 consecutive years a significant negative NK interaction is found.

The Vegetative Growth Index

It has been the practice, ever since the start of this series of fertilizer trials, to record the weight of the 30 leaves sampled, for foliar diagnosis needs, from each plot of these trials.

It has been shown previously the high degree of correlation existing between the weight of leaves so obtained and the actual yield at harvest. It was also shown that in ratoons, the vegetative growth index, though highly correlated with final yield, was not quantitative as in virgins. A possible explanation for this reason was given and it was said that consideration should be taken of the fact that quantitative relationship may vary with the degree of response.

This statement, though not condemning the use of the vegetative growth index, may set a handicap to its use i.e., to measure the degree of response to fertilizer applications.

In fact, in practice very seldom are cases met with, where a fertilizer will cause an increase in yield of the order of 50 per cent or more. Responses of this order can easily be detected by the naked eye and do not need any special means of mensuration. In cases where responses are very high, deficiency symptoms are likely to appear in the control plots, meaning that the case has become a pathological one. The average agricultural practice of cane cultivation in the island is, however, of such a standard that deficiency cases of this order are not common.

Consequently, disregarding these special deficiency cases, the problem, attached to the average practice, mainly aims at investigating the small possible ameliorations on existing methods.

With that in view, if in this series of experiments, the first dose of Nitrogen (i.e., 30 kgs. per arpent) be taken as the one which is approximately the practice on estates, we see that the vegetative growth index gives a most perfect correlation with yield.

	Yield in tons cane per arpent		Comparative Yield		Vegetative Growth Index	
	1N	2N	1N	2N	1N	2N
Virgins ...	33.7	34.1	100	101	100	103
1st Ratoons ...	31.9	32.7	100	103	100	105
2nd Ratoons...	30.9	32.7	100	106	100	106

Foliar Diagnosis

Leaf punches collected from the factorial fertilizer trials in 1947 and further samples collected this year were analysed for N, P_2O_5 and K_2O by the usual methods employed at this Station. Such methods proved to be rather time consuming when dealing with such a great number of samples as was the case; consequently next year will see a change in the analytical methods from the semi-micro ones in use, up to now, to the modern photo electric methods.

It is hoped too to be able to enquire on the advisability of including other elements such as Ca and Mg in the foliar diagnosis technique.

Foliar diagnosis was carried out in these trials especially with a view to determining the optimum content of N, P_2O_5 and K_2O in the dry matter of leaf punches. As it was the case with the virgins, from each trial one plot was selected in first and second ratoons, which, from consideration of the average weight of leaves, was expected to give the best yield with the minimum of fertilizers applied. This plot was considered as the optimum plot of the trial. If the average foliar diagnosis for these plots is determined the following figures are obtained which can be considered to be very near the optimum content.

% Dry Matter (Leaf Punch)			
		1st Ratoons	2nd Ratoons
N ...	...	1.83	1.93
P_2O_5 ...	...	0.46	0.47
K_2O ...	...	1.70	1.61

In the following, the response will be determined after consideration of both yield and weight of leaves so as to decrease the chances of error.

NITROGEN

In 1947, all the trials responded to Nitrogen application. From the data connected with these, the following figures are obtained—

N applied in Kgs. per arpent	N% Dry matter of leaf punch	Vegetative Growth Index	Comparative yield of mil- lable cane	Tons cane per arpent
0	1.45	100	100	24.6
30	1.70	119	130	31.9
60	1.87	125	133	32.7

In 1948, out of 16 trials, 13 gave a definite response to Nitrogen and 3 trials showed only a slight response to Nitrogen. The figures in this connection are given in the following tables—

RESULTS OBTAINED FROM 13 TRIALS SHOWING A DEFINITE RESPONSE TO N

<i>N applied in Kgs. per arpent</i>	<i>N% Dry matter of leaf punch</i>	<i>Vegetative Growth Index</i>	<i>Comparative yield of millable cane</i>	<i>Tons cane per arpent</i>
0	1.50	100	100	22.1
30	1.77	119	140	31.2
60	1.91	126	150	33.3

RESULTS OBTAINED FROM 3 TRIALS SHOWING SLIGHT RESPONSE TO N

<i>N applied in Kgs. per arpent</i>	<i>N% Dry matter of leaf punch</i>	<i>Vegetative Growth Index</i>	<i>Comparative yield of millable cane</i>	<i>Tons cane per arpent</i>
0	1.84	100	100	29.3
30	1.91	107	106	31.1
60	2.11	110	108	31.6

These figures suggest that the optimum for Nitrogen lies between 1.85 and 1.90, and this is in accordance with the ones obtained from the selected plots.

PHOSPHATE

In 1947, there was no definite response to Phosphate but 5 trials showed a slight response which, however, did not reach significance.

RESULTS OBTAINED FROM 5 TRIALS SHOWING SLIGHT RESPONSE TO P_2O_5 (1947)

<i>P_2O_5 applied in Kgs. per Arpent</i>	<i>P_2O_5% Dry matter of leaf punch</i>	<i>Vegetative Growth Index</i>	<i>Comparative yield of millable cane</i>	<i>Tons cane per Arpent</i>
	0.41	100	100	26.8
25	0.45	104	106	28.5
50	0.43	106	110	29.4

The remaining 12 trials showed no response to Phosphate and the Phosphate content of the zero plots was 0.46 per cent.

In 1948, one estate gave a definite response to P_2O_5 with the following results.

<i>P_2O_5 applied in Kgs. per Arpent</i>	<i>P_2O_5% Dry matter of leaf punch</i>	<i>Vegetative Growth Index</i>	<i>Comparative yield of millable cane</i>	<i>Tons cane per Arpent</i>
0	0.44	100	100	28.1
25	0.48	105	113	31.7
50	0.55	110	119	33.3

The average content of the zero plots from the trials showing no response to P_2O_5 was 0.48 per cent.

From consideration of these figures, it may be taken that the optimum for P_2O_5 is around 0.45 per cent. This figure, once more, is in accordance with that obtained from the selected plots.

POTASH

In 1947, one trial gave a definite response to Potash, while five others gave only a slight response.

RESULTS OBTAINED FROM 1 TRIAL SHOWING DEFINITE RESPONSE TO K_2O

K_2O applied in Kgs. per arpent	K_2O % Dry matter of leaf punch	Vegetative Growth Index	Comparative yield of millable cane	Tons cane per arpent
0	1.04	100	100	15.3
30	1.25	107	108	16.5
60	1.50	108	124	19.0

RESULTS OBTAINED FROM 5 TRIALS SHOWING SLIGHT RESPONSE TO K_2O (1947)

K_2O applied in Kgs. per arpent	K_2O % Dry matter of leaf punch	Vegetative Growth Index	Comparative yield of millable cane	Tons cane per arpent
0	1.39	100	100	29.1
30	1.57	104	104	30.3
60	1.74	105	105	30.5

The K_2O content for the zero plots for the trials showing no response was 1.81 per cent.

In 1948, only two trials showed a slight response to K_2O , while the remaining 14 showed no response.

RESULTS OBTAINED FROM 2 TRIALS SHOWING SLIGHT RESPONSE TO K_2O (1948)

K_2O applied in kgs. per arpent	K_2O % Dry matter of leaf punch	Vegetative Growth Index	Comparative yield of mil- lable cane	Tons cane per arpent
0	1.24	100	100	31.3
30	1.59	106	105	33.0
60	1.67	109	108	33.9

Those trials showing no response to K_2O had their zero plots with a K_2O content of 1.66 per cent. From these figures, it will be noted that even with 1.39 per cent K_2O there was a slight response, though this response was not significant. Now, the optimum content of K_2O in the selected plots lies around 1.65 per cent, but on the other hand, it is obvious from the above figures that a supplementary 30 Kgs. of K_2O per arpent though entering the leaf has not caused any increase in yield when the K_2O content was 1.57 per cent. This fact is entirely in accord with the usual behaviour of K_2O , known as luxury consumption. The figure adopted for K_2O will be 1.40 per cent dry matter. This work therefore suggests that the contents of leaf punches in N,P,K, below which a response in yield is to be expected after application of the appropriate fertilizer are as follows—

% Dry matter (Leaf punch) for M. 134/32 ratoons

N	...	1.85
P_2O_5	...	0.45
K_2O	...	1.40

Effect of Differential Fertilization on Sugar Content of Sugarcane

Sugar analyses of composite samples of cane from the factorial experiments were made, as usual, at the Experimental Cane Mill, at Réduit.

The results are as follows—

	Nitrogen			Phosphoric Acid			Potash		
	0	1	2	0	1	2	0	1	2
Commercial Cane Sugar (1948)	13.54	13.63	13.07	13.04	13.37	13.23	12.73	13.04	13.14
Tons Sugar per Arpent (1948)	3.06	4.22	4.27	3.68	3.88	3.86	3.56	3.79	3.85
C.C.S. Average for 3 Crops	12.09	11.90	11.67	11.83	11.95	12.00	11.68	11.82	11.70

The average figures for the virgins and the two ratoon crops show a gradual decrease in sugar content as the Nitrogen fertilization is increased. The first dose of Nitrogen has, however, increased noticeably the yield of sugar per arpent and no difference is obtained between the first dose and the second dose.

The corresponding figures for Phosphate show a trend to increase with increasing phosphate fertilization, whilst Potash does not seem to have any effect on the sugar content.

Composition of the Sugarcane Plant at Harvest

Samples of the different aerial organs of the sugarcane plant taken from the factorial experiments in 1947, in first ratoons, were analysed this year for N, P_2O_5 , K_2O , CaO , MgO and SiO_2 .

The samples were taken from these plots which were expected, after consideration of their vegetative growth index, to give the maximum yield with the minimum of fertilizers applied.

The technique of sampling has been the same as for the virgins and was described in the 1946 Annual Report of the Station.

The following table gives the average figures from 16 estates for M.134/32 ratoons, 11 months old—

	Fresh matter		Dry matter		Kgs. per arpent					
	Tons per Arp.	H ₂ O %	Tons per Arp.	% of Total	N	P ₂ O ₅	K ₂ O	CaO	MgO	SiO ₂
Millable canes...	33.22	74.23	8.56	58.3	24.82	10.27	55.64	12.41	6.51	95.02
Trash	4.95	25.05	3.71	25.3	14.10	3.71	21.89	26.64	5.64	191.07
Green tops ...	9.61	74.92	2.41	16.4	22.65	7.71	46.51	11.83	3.98	69.89
TOTAL	47.78	69.28	14.68	100.00	61.57	21.69	124.04	50.88	16.13	355.98

These figures show the large amount of plant food that is removed from the soil by the different organs of a sugarcane crop. As the millable canes and part of the trash and green tops are usually exported every year, restitution of factory residues and of pen manure deriving from the trash and green tops, becomes essential, unless the amount of nutrients thus exported is replaced by the equivalent amount in fertilizers in order to maintain the fertility level.

The figures given above are averages for 16 estates ; when these are subdivided into different climatic zones the figures show wide deviations from the average.

Of the sixteen trials under consideration, 3 fell in the subhumid zone, 8 in the humid zone and 5 in the superhumid zone.

The following table shows the amount of the different constituents in the whole plant associated with 1 ton of millable cane. The figures are in kilogrammes and are given for the 3 climatic zones.

			N	P ₂ O ₅	K ₂ O	CaO	MgO	SiO ₂
Subhumid	...	...	1.91	0.70	4.71	1.45	0.47	14.16
Humid	...	...	1.80	0.61	3.76	1.44	0.44	10.88
Superhumid	...	...	1.95	0.67	3.15	1.74	0.57	8.45
GENERAL AVERAGE			1.85	0.65	3.73	1.53	0.49	10.71

It is seen from the above table that the contents of K₂O and SiO₂ drop progressively from the subhumid zone to the superhumid zone. CaO and MgO do not show any difference in the subhumid and humid zones, but a greater absorption seems apparent in the superhumid zone.

It is interesting to compare the above figures for N, P₂O₅ and K₂O with the corresponding foliar diagnosis and the average fertilization these plots received.

Foliar Diagnosis				Average Fertilization Kgs./Acp.		
	N	P ₂ O ₅	K ₂ O	N	P ₂ O ₅	K ₂ O
Subhumid ...	1.73	0.47	2.02	60	17	10
Humid ...	1.87	0.44	1.66	60	6	19
Superhumid ...	1.86	0.46	1.67	42	20	36

These figures show the necessity of a higher potash fertilization for the superhumid zone in order to maintain the optimum K₂O concentration in the plant. Nitrogen, on the other hand, is needed in a lesser amount in the superhumid zone. This applies not only to yield of cane but also to the sugar content.

Permanent Trials at Central Experiment Station

TRIAL 69

This trial, comparing two varieties at two different levels of fertilization, was harvested in 5th ratoon with the following results—

Tons cane per arpent			
	High Fertilization	Low Fertilization	Response to higher level
M.134/32 ...	33.4	11.5	+21.9
M.112/34 ...	34.2	15.4	+18.8

The low fertilization (which in this trial is about one-fourth normal estate fertilization) has brought down the fertility level of these plots almost to that frequently met with in small planters' lands.

Considering the results of the 6 crops together, it is obvious that the response of M.134/32 to fertilization is higher than that of M.112/34.

Table giving average figures per crop—

		Tons cane per Arpent		
		High Fer- tilization	Low Fer- tilization	Response to Higher Level
M. 133/32	...	30.9	15.2	+15.7
M. 112/34	...	29.8	17.3	+12.5
M. 134/32 compared with M. 112/34	...	+1.1	-2.1	+ 3.2

While M.134/32 has yielded 2.1 tons per arpent less than M.112/34 in the low fertilized plots, it has, on the average, yielded 1.1 tons more in the high fertilized plots.

This trial has now been uprooted and a fourth repetition started with M.423/41 and M.134/32 on the same lay out as previously.

BIO 5

This trial, planted with M.112/34, with the object of comparing the effect of complete fertilization and withholding phosphate and potash, was harvested in 4th ratoon. The results are given in the following table—

		Tons cane per arpent	Comparative Yield	
Complete	...	33.9	185	126
— P	...	27.0	—	100
— K	...	18.3	100	—

The increases in yield due to Phosphate and Potash fertilization are thus seen to be of the order of 26 and 85 per cent respectively.

The—K plots of this trial provided excellent material which was used by this Division to demonstrate Potassium deficiency symptoms at the *Maisons Claires* Exhibition held during the year.

The plants showed slender stalks with the typical fan like appearance ; marginal scorch and spotting of the leaves ; superficial reddish discoloration on the upper surfaces of midribs of older leaves and “ firing ” of the tips.

This trial is being continued this year in 5th ratoons.

Visits to Estates

Early during the year under review, a certain number of requests were received by the Department from planters who were anxious about the state of their plantations. Some of these cases, after investigation by the Plant Pathologist who saw no evidence of plant disease, were referred to the writer. Thus, some estates were visited and advice given in case of deficiency. In doubtful cases, leaf samples had to be taken and analysis carried out before any advice could be given.

In connection with these visits, Nitrogen deficiency was seen at Britannia and Belle Isle ; Phosphate deficiency at Joli Bois, Grand Sable and Belle Isle ; and Potash deficiency at Grand Sable, Joli Bois, Surinam, Bassin and Fond du Sac.

Lime Trials

It is not uncommon to see the poor growth of sugarcane in the highly leached soils of the superhumid zone. It is a known fact that soils of this region are very, if not excessively, acid.

Further, the continual use of acidic fertilizers such as Sulphate of Ammonia, Ammonium Chloride etc. will no doubt increase the soil acidity. It is also known that in acid soils many plant foods are held in an unavailable form. With this in mind, it was decided to carry out a comprehensive series of factorial experiments with 3 levels of Lime, Magnesia and Potash.

Five such trials have already been laid down with the standard variety M.134/32 and a few more are being established so as to cover all the climatic zones of the island.

It is hoped that these trials will prove valuable as only very little information is available in this country on the effect of Lime and Magnesia on the yield and sugar content of sugarcane, and also in providing useful data for the extension of the foliar diagnosis technique in order to include Ca and Mg in addition to N, P and K, should this be found of interest.

SYDNEY M. FEILLAFÉ,
Assistant Chemist.

PART III—BOTANICAL DIVISION

General

Owing to shortage of staff and the secondment of the Botanist for duty with the Mauritius Economic Commission, the research programme of the Botanical Division had to be curtailed.

The Assistant Botanist was appointed on the 20th of July and assumed duty on that date. On the 12th of November, the Botanist, Dr. H. Evans, left the Colony on secondment to Trinidad and the Assistant Botanist then took charge of the Division.

Weed Control Investigations

During the year under review considerable attention was given to demonstrations of the new chemical weed control methods to big and small planters and to estates. At these demonstrations, those methods which have been found most suitable as a result of work previously accomplished were used and full information was given on the technique of the methods employed. The Field Demonstrators who were instructed in the technique used to control most of the weed species, gave valuable assistance in acting as propaganda officers for such control in their respective districts.

Most of the work carried out on weed control this year mainly aimed at evolving better methods of control for those weed species which have, so far, proved resistant to the hormone weed killers and at carrying out some investigations on the weed species on which no data had been previously obtained.

The Botanist, prior to his departure to Trinidad, carried out a series of investigations in this direction ; the result of his work and the conclusions he arrived at are, hereunder, recorded—

Paederia foetida Linn. This weed species locally known as *liane lingue* is susceptible to the hormone weed killers, but owing to the relatively small leaf surface, the long creeping stems and the large stores of reserve starch held in the stem tissues, it is extremely difficult to eradicate even with relatively high concentrations of the hormone herbicides. The problem has thus been one of introducing into the plant the maximum quantities of the applied hormone under conditions such as to enable deep penetration of the hormone into the tissues. The most effective way of accomplishing this has been to spray the plants with a solution of isopropyl ester of dichlorophenoxyacetic acid in diesel oil. The isopropyl ester has been available in Mauritius as Esterone 44 and Barweed 44—both containing 44 per cent of the ester, equivalent to 37 per cent active acid. The effective concentration is from 1 to 1.5 per cent of the Esterone 44 or Barweed 44 as purchased, in diesel oil (i.e., a concentration of 0.37 to 0.55 per cent in terms of active acid). These substances are completely miscible with diesel oil. The oil gives a much better spread on the leaf surface, than an aqueous solution even when the latter is used with optimum amount of wetting agent. With this method a rapid kill of the shoots for a considerable distance is obtained. When the

weed existed in walls 3 to 4 feet high it has frequently taken 2 to 3 months for any shoots to appear following a single application, and the number of shoots which emerge is not large and may subsequently be killed back by spot spraying with the same solution.

To avoid waste of solution it is necessary to use nozzles with smaller orifices than those optimum for the application of aqueous spray solutions. Normally a rate of 60 to 75 gallons per arpent is sufficient to give complete coverage.

Although the cost of the treatment is somewhat high, yet it has been found to be economical and is of particular value to prevent reinfestation following the relieving of walls. In these circumstances pieces of stem or roots or seeds carried out by birds result in a few shoots appearing in the wall. Left untreated the wall, in a short time, becomes completely infested by the weed. Close controls of shoots as they appear, by spot spraying with the oil solution enables the walls to be kept free of the weed at a low cost.

Cyperus rotundus Linn. (Herbe a Oignon ; nut grass).

Further experiments were also carried out on the control of this weed species. Complete eradication of this weed is difficult owing to the large number of tubers in the soil. Comparative tests with 2, 4-D as sodium salt, as isopropyl ester and as the triethanolamine salt and with Agroxone in aqueous solution and of the isopropyl ester of 2, 4-D in diesel oil were made at 0.25 per cent, 0.50 per cent and 0.75 per cent active acid. Applications were repeated at intervals. Apart from a somewhat lower effectiveness of the sodium salt 2, 4-D there was little to choose between the treatments.

The diesel oil solution of the isopropyl ester of 2, 4-D was the most effective, provided that 100 gallons per acre was used ; 50 gallons per acre was much less effective. After one application of 0.75 per cent isopropyl in diesel oil at 100 gallons per acre the plots were free of the weed for 3 months ; but subsequently new shoots appeared. Even two applications did not completely eradicate the weed though about 80 per cent control was obtained. Aqueous solutions were less effective.

For cane plantations the most economical treatment is still to spray the cane furrows only with 0.25-0.30 per cent active acid either as Agroxone or 2, 4-D, the applications being repeated as considered necessary. This prevents the weed from competing with the cane in the early stages and by spraying the furrows only the cost of application is kept down.

Comparative tests made with several herbicide preparations gave the following results—

Ambrosia artemisiifolia Linn. (Herbe Solferino). Complete control obtained at the standard rate of 100 gallons per acre with Esterone 44 and Barweed 44 (both isopropyl esters of 2, 4-D) at 0.2 per cent active acid ; with Barweed 40 (triethanolamine salt of 2, 4-D) and liquid Agroxone (M.C.P.A.) at 0.25 per cent ; with ordinary Barweed, Niagara and Sodium 2, 4-D at 0.30 to 0.35 per cent.

Hydrocotyle bonariensis Lam. (Herbe bol). Under the conditions of the experiment—continuous fine weather—there was no difference in activity between Esterone 44 Barweed 44, Barweed 40 and Agroxone when applied at 100 gallons per acre at 0.1 per cent active acid. Two applications were necessary for complete control. Sodium 2, 4-D was slightly less effective but the difference was of little commercial significance.

Cardiospermum halicacabum Linn. (Liane poc-poc). All the substances were fully effective at 0.1 per cent active acid applied at 100 gallon per acre ; no difference between the preparations could be established.

Conclusions

For very susceptible weeds there is relatively little difference between the various forms of 2, 4-D and Agroxone used provided that weather conditions are favourable when the applications are made. For certain resistant weeds, particularly *Liane Lingue* (*Pæderia foetida*) ; Songe (*Alocasia macrorhyza*) when growing in marshes or along irrigation canals and *Verbena* sp., a solution of the isopropyl ester of 2, 4-D in diesel oil is considerably more effective. In general, therefore, the chief consideration should be the price of the products based on the equivalent active acid content and the isopropyl ester of 2, 4-D, which is more expensive, but which has the advantage of being miscible with diesel oil, should only be used for these special borderline weeds.

Investigations on the Fertilizing Value of Crushed Basaltic Rock

Lay out. A $3 \times 2 \times 2$ factorial experiment was laid down in October 1947, at Hermitage (Highlands S.E.) consisting of three replications of zero (B_0) ; 91 tons (B_1) and 182 tons (B_2) of basalt per acre with ordinary estate fertilization and double the ordinary estate fertilization and with the varieties M.134/32 and M.63/39.

Application of Basalt. The basalt was applied before planting as follows—

B_1 plots: 30 tons at the bottom of the furrows and 26 tons on the interlines.

B_2 plots: 30 tons at the bottom of the furrows and 82 tons on the interlines.

Later on, more basalt became available and this was applied at the following rates: B_1 plots 35 tons ; B_2 plots 70 tons.

These two applications amounted then to a total of 91 tons per acre for the B_1 plots and 182 tons per acre for the B_2 plots. The second application was spread on the furrows and for a distance of 1 to $1\frac{1}{2}$ feet from the centre of the furrows on either side.

Application of fertilizers. The ordinary estate fertilization per acre (F_1) consisted of: 5 tons of scums ; 5 tons of farmyard manure ; 3 tons of a mixture of molasses, ashes and scums ; 260 kgs. of guano phosphate ; 90 kgs. of nitrate of soda ; 50 kgs. of muriate of potash ; 50 kgs. of super-phosphate and 50 kgs. of sulphate of ammonia.

Double the ordinary estate fertilization (F_2) was given twice these quantities. It must be stated, however, that the ordinary estate fertilization is much higher than the average fertilization of all the fields in that locality.

Germination and Growth. Germination was excellent and a full and even stand of cane was obtained. Some shoots in both varieties were killed by borers and there was a slight infection of chlorotic streak in the variety M.63/39.

Leaf Samples. Samples of leaves of the third rank were taken in April, that is, six months after planting. Although the leaf samples taken for virgins at six months cannot be compared as regards critical levels with samples taken at 8 to 9 months (the appropriate time) the analytical data are comparable.

The results of the analysis for potash content showed the following data—

TABLE I

POTASH CONTENT— $K_2O\%$ DRY MATTER (WHOLE LEAF)

Fertilization	Variety M. 134/32			Variety M. 63/39		
	No Basalt	Basalt 91 tons per acre	Basalt 182 tons per acre	No Basalt	Basalt 91 tons per acre	Basalt 182 tons per acre
Single estate fertilization ...	2.36	2.46	2.53	2.30	2.46	2.50
Double estate fertilization ...	2.96	3.06	3.04	3.00	3.03	2.98

The above figures indicate that Basalt may have increased the potash content of the varieties under ordinary estate fertilization but not under double estate fertilization ; however, it would be too premature to draw a conclusion at this stage of experimentation.

Basalt, on the other hand, has not resulted in any consistent or appreciable effect on the nitrogen, phosphate, magnesium and calcium contents.

Pre-harvest Sucrose Analysis. Pre-harvest samples of cane taken for sucrose analysis in August gave the following data—

TABLE II

SUCROSE % CANE

Variety	Basalt		
	Nil	91 tons per acre	182 tons per acre
M. 134/32 ...	8.63	8.75	8.65
M. 63/39 ...	7.51	7.26	7.14

From these figures it may be inferred that there has been a gradual decrease in sucrose content with corresponding increase in applications of basalt in variety M.63/39 whereas the sucrose content had not been affected in the variety M.134/32 under the same conditions of experimentation.

Harvest. The trial was harvested in November and a statistical analysis of the results showed the following data—

TABLE III

<i>Basalt</i>	<i>Yield in tons cane per arpent</i>	<i>% Control</i>	<i>C.C.S. % cane</i>
No basalt ...	31.9	100	10.15
91 tons per acre ...	33.5	105	9.97
182 tons per acre ...	36.3	113.8	9.65

Significant Difference ($P=0.05$) for yield ± 2.3 .

TABLE IV A

<i>Variety</i>	<i>Yield in tons cane per arpent</i>
M. 134/32 ...	27.8
M. 63/39 ...	40.1

TABLE IV B

<i>Fertilization</i>	<i>Yield in tons cane per arpent</i>
Single Estate fertilization	33.1
Double Estate fertilization	34.7

Significant Difference ($P=0.05$) ± 1.86 both for variety and fertilization.

Reference to Table III shows that an application of 182 tons of basalt per arpent gave a significant increase in yield over both an application of 91 tons per arpent and no basalt whereas the application of 91 tons gave an appreciable increase in yield of canes, which however, failed to reach significance.

Data from Table IVb show that there was a response towards the double estate fertilization over the single estate fertilization, but this response, though highly suggestive, did not reach significance.

The differential response of the two varieties to applications of basalt both in yield of cane and in sucrose content is given below—

TABLE V

<i>Variety</i>	<i>C.C.S. % Cane</i>			<i>Yield in tons per arpent</i>		
	<i>No. Basalt</i>	<i>Basalt 91 tons per acre</i>	<i>Basalt 182 tons per acre</i>	<i>No. Basalt</i>	<i>Basalt 91 tons per arpent</i>	<i>Basalt 182 tons per acre</i>
M. 134/32	10.9	11.2	11.1	26.5	26.6	30.1
M. 63/39	9.3	8.7	8.2	37.2	40.5	42.4

The data shown in this Table indicate that there was no response in sucrose content with applications of basalt in the variety M.134/32 whereas an appreciable decrease occurred in the variety M.63/39. These data are highly comparable to those obtained from the pre-harvest sucrose analysis where a similar trend of events was observed. Basalt on the other hand, has consistently increased the yield of canes in both varieties.

Conclusions. These preliminary results are highly encouraging in so far as an appreciable increase in yield of canes was produced. The investigations in this direction will be continued on the ratoon crops so as to obtain further data with a view to evaluating the response of these soils to applications of basalt.

Field Trials on Accessory Fertilizers

Five trials were laid down on the poor leached soils of the wet districts with a view to obtaining some information as to the effect of supplementing various elements on the yield and sucrose content of cane grown in these localities.

The lay out was made on the Latin square system of replications, and treatments were arranged so as to test the effect of Magnesium, Potassium and the trace elements Zinc, Copper, Manganese and Boron.

Of these trials one was established at Olivia (Beau Champ S.E.) another at St. Avold (Britannia S.E.) and three others at Hermitage (Highlands S.E.). The trial at Olivia has been carried out on virgin canes and is to be harvested in 1949. The St. Avold trial was laid down on a ratoon field and the statistical analysis of the data showed no responses in yield of canes to extra potassium or to magnesium or to trace elements; further, no information could be derived from sucrose determinations owing to a high variance in the figures.

Of the experiments laid down at Hermitage, one showed no response to any treatment while in another a response to potash was obtained. The third trial was established on a virgin field planted with varieties M.134/32 and M.63/39. This consisted in two replications of an application of 250 lbs. of magnesium sulphate per arpent, and no magnesium sulphate. The results obtained from this trial gave the following data—

TABLE VI

<i>Treatment</i>	<i>Variety M. 134/32</i>		<i>Variety M. 63/39</i>	
	<i>Yield tons cane per arp.</i>	<i>C.C.S% cane</i>	<i>Yield tons cane per arp.</i>	<i>C.C.S% cane</i>
Magnesium sulphate ...	30.5	12.4	45.0	9.4
No magnesium sulphate ...	26.8	11.9	43.3	8.8

In both varieties the application of magnesium produced an increase in yield of canes and sucrose content. Although the results of this experiment show a suggestive response to magnesium, yet, no such response was observed in the other trials in which magnesium was applied. From the data so far obtained no definite conclusion on the possible influence of magnesium on cane yield and sucrose content can be arrived at and the present position requires further investigation.

Investigations on the Use of Organo-Mercurial Compounds in the pre-Treatment of Sugarcane Cuttings

A trial was established at the Central Experiment Station, Réduit, with a view to testing the efficacy of Aretan relatively to other new sugarcane disinfectants. The experiment consisted of 15 treatments in each of 6 randomised blocks and was at the same time planned out to give information as to the effect of planting the cuttings with farmyard manure and artificial fertilizers,

The results are summarised in Tables VII and VIII given below—

TABLE VII

<i>Treatment</i>	<i>No. of germinated cuttings per plot (Max. No. 60)</i>	<i>Total length of shoots per plot</i>	<i>No. of cuttings infected with pineapple disease per plot (Max. No. 60)</i>
Controls	5	55	59
Aretan 1%	45	703	22
Aretan 1½%	36	559	32
Abavit S 1½%	49	828	19
Abavit S 1%	44	769	21
Cadet S.D.M. 100 ccs./gallon	24	411	48
Cadet S.D.M. 50 ccs./gallon	19	253	50
Agrosan GN 1%	30	738	28
Agrosan GN ½%	37	625	36
Hortosan DP 2 oz./10 gallons	37	608	33
Hortosan DP 1 oz./10 gallons	23	345	44
R 1104 × 51 1%	29	425	42
R 1104 × 51 ½%	18	230	51
R 1334 × 14 1%	28	296	45
R 1334 × 14 ½%	23	289	44
Significant Difference (P=0.05)	±9.8	±185.5	±12.4

TABLE VIII

<i>Treatment</i>	<i>No. of germinated cuttings per plot (Max. No. 60)</i>	<i>Total length of shoots per plot</i>	<i>No. of cuttings infected with pineapple disease per plot (Max. No. 60)</i>
Artificial fertilizers	27	432	44
Farmyard manure	37	588	30
Controls	33	495	37
Significant difference (P=0.05)	±5.3	±95.9	±6.5

The following are the main observations which emerge from these data—

1. All treatments gave a significant increase in the number of cuttings germinated and the total length of shoots.
2. A significant reduction in the incidence of pineapple disease occurred in all treatments except with Cadet S.D.M. at both concentrations and R 1104 × 51 at the low concentration.
3. Abavit S, Aretan, Agrosan GN and Hortosan DP were the best treatments. As far as the number of germinated cuttings and pineapple disease incidence are concerned, Abavit S was found more effective than Agrosan GN and Hortosan DP. Aretan and Abavit S compared favourably.

4. There was no significant increase in the pineapple disease incidence when the low concentration was used instead of the high one.
5. The artificial fertilizers gave a significant reduction in the number of germinated cuttings, total length of shoots and further increased pineapple disease incidence.

Investigations on Yield Effects of Interplanting Foodcrops with Sugarcane

Six trials planned out on the Latin square system of replication have been laid down in different localities so as to obtain the yield effects of interplanting foodcrops with sugarcane. Two foodcrops have been included, whenever possible, in each trial and all combinations of sugarcane alone ; sugarcane interplanted with a crop in alternate interlines and sugarcane interplanted with a crop in every interline have been used.

The trials established and the foodcrops so far planted are given below—

Benares S.E.	...	...	one trial with maize and groundnuts
Britannia S.E.	...	...	one trial with maize and sweet potatoes
Solitude S.E.	...	...	one trial with maize and groundnuts
Ferney S.E.	...	...	one trial with maize and groundnuts
Plaines Wilhems Experimental Station	} (a) one trial with maize and potatoes } (b) another trial with eddoes.		

The experiments are in progress and no information is at present available.

Field Trials on Secondary Crops

1. *Linseed*. Some years ago, the Officer-in-charge of the Sugarcane Research Station planted some experimental plots of linseed using seed of unknown variety procured locally. Since that time, small plots of linseed were planted every year and observations on these plots indicated that a crop could be successfully produced in the cool uplands of the island during the winter months.

In September 1947 small quantities of seed of the varieties Rio, Punjab and Royal were obtained for trial, following the initiative of the Agricultural Adviser to the Secretary of State.

The seed arrived too late for trials in the 1947 season. Multiplication plots were, however, laid down with part of the seed while the remainder was reserved for planting a variety trial in the 1948 season. The trial, planned out as a variety-and-time-of-planting trial, was laid down at Plaines Wilhems Experimental Station. The first planting was made on the 1st of April ; apart from seeds of the variety Royal which showed low viability, germination had

been excellent. At the seedling stage, however, the linseed experiment suffered from a fairly high infestation of cut worms ; from the observations made on the performance of the varieties it was established that the local variety matured earlier than the imported varieties and was much shorter. Both Rio and Royal showed excellent growth in height, but Royal later lodged considerably. The first plantings of the local variety were ready for harvest in exactly four months from the date of planting whereas those of the imported varieties took $4\frac{1}{2}$ to 5 months to reach the harvest stage.

Yields obtained from that first planting were as follows—

	<i>Punjab</i>	<i>Local</i>	<i>Rio</i>
Mean yield of air dry seed in kgs/acre at 1st planting ...	389	309	186
Yield of highest yielding plots in kgs/acre	499	362	234

The second planting made on the 1st of May showed excellent growth at the start, but when the capsules were ripening heavy rain fell and many plots were affected by fungal disease which resulted in the death of many plants.

Yields obtained from the second planting were thus considerably lower.

	<i>Punjab</i>	<i>Local</i>	<i>Royal</i>	<i>Rio</i>
Mean yield of air dry seed in kgs/acre at 2nd planting ...	175	162	260	61

The third planting, made on the 1st June, was seriously affected by the disease which was identified by the Plant Pathologist as Anthracnose caused by *Colletotrichum* sp., possibly *C. lini*.

The results of this trial indicate the superiority of Punjab over the other varieties under the soil and climatic conditions prevailing in this locality.

A further trial was laid down in September at the Central Experiment Station, Réduit, to determine the fertilizer requirements of linseed and also to evaluate the imported varieties under the conditions occurring in this locality. This experiment was in the form of a $2 \times 2 \times 2$ fertilizer trial with all combinations of nitrogen at levels of nil and 125 kgs. Sulphate of ammonia per acre ; Potash at levels of nil and 125 kgs. Muriate of Potash per acre and Phosphate at levels of nil and 200 kgs. guano phosphate per acre. Two complete replications for each of the varieties Rio, Punjab and Royal were made. The fertilizers were applied broadcast but turned and worked down into the soil with the hoe before planting. The seeds of Rio and Royal were the first to germinate while those of Punjab germinated a week later. From the very beginning growth was checked at the seedling stage by a severe outbreak of " damping off " disease which necessitated frequent recruiting in order to obtain reasonably good stands of plants on the plots.

Yields obtained from the varieties under the differential fertilizer treatments are shown in Tables IX and X given below—

TABLE IX

<i>Treatments</i>	<i>Yields in grams per plot</i>
O	166.1
N	150.5
P	207.0
K	154.0
NP	174.0
NK	138.5
PK	199.3
NPK	227.0
Significant difference ($P=0.05$)	± 45.3

TABLE X

<i>Varieties</i>	<i>Yields in grams per plot</i>
Rio	208.6
Royal	158.0
Punjab	164.5
Significant difference ($P=0.05$)	± 27.7

From these figures it may be inferred that Rio, under the conditions prevailing at Réduit, gave a significantly higher yield than Royal and Punjab. Furthermore, a significant increase in yield was obtained when a complete fertilization was applied.

Reference to Table IX shows that Nitrogen has depressed the yield, the figures being—

Total without Nitrogen	...	...	= 726.4 grams
Total with Nitrogen	...	...	= 690.4 "

Potash and Phosphate have, on the other hand, increased the yield—

Total without Phosphate	...	...	= 609.1 grams
Total with Phosphate	...	...	= 807.3 "
Total without Potash	...	...	= 698.0 "
Total with Potash	...	...	= 718.8 "

Conclusion. From this preliminary work it would appear that linseed might be successfully grown in the cool uplands of the island during the winter months. At this stage of experimentation it is too premature to decide as to the fertilizer requirements of this crop ; further investigations in this direction will then prove of great value when large scale trials will be contemplated.

Sorghum. Several varieties of sorghum seed were received from Turkey and a collection of dwarf varieties was imported from the United States. The seed did not reach Mauritius in good condition so it was not possible to reserve them for sowing in the hot season. Part of the seed was then sown at the Tobacco Research Station so as to secure planting material of the individual varieties for further trials later on.

The plants did not thrive well in the cool season owing to the low temperature prevailing at that period of the year. A certain number of plants was, however, saved being placed under glass panes so as to improve their temperature requirements. Sufficient seed has been obtained from these plants for the establishment of multiplication plots in the proper season.

Soya Beans. A variety, liming and inoculation experiment was laid down at Plaines Wilhems Experiment Station. The germination of the seed was poor in most of the varieties and furthermore the seedlings suffered from a high infestation of cut worms. Recruiting was done wherever possible as, for some varieties, no fresh seed was available. As a result many blanks were left in the experiment.

The only information that has been derived from that experiment is—

- (a) Plants from the uninoculated series showed no nodules while those from the inoculated series had nodules ;
- (b) Phosphate and Potash when applied at the bottom of the hole before planting had a deleterious effect on the germination ; for seeds planted without fertilizer were superior in germination and establishment. Fertilizer then should be applied at least a week before planting.
- (c) Under conditions at Plaines Wilhems Experiment Station, the seed should be only slightly covered with soil, say $\frac{1}{4}$ " to $\frac{1}{2}$ " of soil ; otherwise the seed is liable to rot before germination occurs.

Oats. A trial was laid down at Plaines Wilhems Experiment Station with a view to obtaining the fertilizer requirements of oats. Unfortunately, the experiment was ruined at the flowering stage owing to a severe outbreak of smut disease.

E. ROCHECOUSTE,
Acting Botanist.

PART IV—EXTENSION SERVICE DIVISION

Staff

During the year under review the work of the division was carried out by one Senior Field Demonstrator and three Field Demonstrators.

One Field Demonstrator was in charge of the Northern Districts, another of Moka-Flacq Districts and the third of Grand Port-Savanne Districts.

Policy

The policy generally adopted has been to contact small planters through the Co-operative Credit Societies because the members of these societies constitute, as a rule, the more progressive type of planters and are consequently more likely to improve their cultural methods, under proper guidance, and exert a good influence over the other small planters. Several planters not belonging to the Co-operative Credit Societies have, however, proved very progressive and have been very helpful in connection with the laying out of demonstration plots.

Propaganda

Small planters' meetings were organised in almost all localities with the help of the Co-operative Credit Societies. During these meetings lectures were given by the Field Demonstrators on various aspects of the sugarcane cultivation, indicating the improvements that could be achieved in the various lines and supporting their statements by appropriate demonstrations whenever possible.

Foliar Diagnosis

Following the investigations carried out by the Sugarcane Research Station on Foliar Diagnosis in connection with the sugarcane, a survey was made in order to determine the extent of the mineral deficiencies in small planters' fields.

Prior to the collecting of leaf samples the principles and aim of Foliar Diagnosis were clearly explained to the planters.

A total of 646 leaf samples have been collected from small planters' fields in all the districts of the island. The analysis of these samples has been carried out in the laboratory of the Sugar Industry Reserve Fund, the cost being paid by the Sugarcane Research Station.

This investigation has revealed a marked and widespread deficiency in the Nitrogen, Phosphate and Potash contents of small planters' fields. However, as Mr. P. Halais, the Director of the laboratory, has pointed out in his report, the extent of these deficiencies, specially as far as Nitrogen is concerned, has probably been accentuated by the fact that a large number of the samples had to be taken during a comparatively dry period. In order to avoid, in future, the introduction of this source of error, Mr. Halais has issued a revised circular in connection with the sampling method to be followed.

Unfortunately, the amount of Nitrogenous and Potassic artificial fertilizers available on the market is still limited and, at this stage, it will serve no purpose to indicate to the planters concerned the proper amount of these artificials that they should apply to their fields in order to make up the deficiencies revealed. However, their present status could be improved if they were made to use their maximum allocation. On the other hand, the supply of Phosphatic Guano being unrestricted, it will be possible to induce the planters to make up the Phosphate deficiencies in their fields by applications of this fertilizer which is very seldom used by them.

Artificial Fertilizers

Six demonstration plots planted in 1947 or earlier, in order to illustrate the effect of Phosphatic Guano on the yield of sugarcane, have been harvested during the year. In every case, half of the plot received the usual amount of fertilizers applied by the planter and the other half received in addition, Phosphatic Guano at the rate of 300 kgs. per arpent.

The results obtained are given in Table I below—

<i>Locality</i>		<i>Treated</i>	<i>Untreated</i>
		<i>+Phosphatic Guano</i>	<i>-Phosphatic Guano</i>
		<i>Metric tons</i>	<i>Metric tons</i>
		<i>per arpent</i>	<i>per arpent</i>
Camp des Ambrevades	...	29.2	26.2
Solferino		40.2	38.2
Camp Fouquereaux		29.8	29.8
Mont Ida		26.1	23.4
Cluny		25.5	24.3
Escalier		33.9	33.4
AVERAGE	...	30.8	29.2

As may be seen, the above figures show an increase in yield which confirms the results of the Foliar Diagnosis.

No statistical calculations of these results could be made due to the fact that the plots had been arranged in a very simple manner, the main object being visual demonstration to small planters.

A new series of Demonstration Plots has been started to show the effect of balanced fertilization. In view of the difficulties previously experienced in obtaining from the small planters themselves the artificial fertilizers required for the demonstration plots, it was decided to run this series of plots on new lines: All arrangements were made through the Presidents or Secretaries of the Co-operative Credit Societies and the Sugarcane Research Station supplied the required fertilizers.

The variety M.134/32 has been adopted for all the plots in this series. Twenty plots were of virgin canes and twenty-four of ratoon. The selection of the fields in this case has been made in the light of the Foliar Diagnosis investigations, the object in view being to illustrate in a more conspicuous manner the mineral deficiencies of the fields and the beneficial effect of an adequate fertilization.

An interesting observation made by one of the Field Demonstrators is the fact that in a number of plots the young canes treated with phosphates appear to suffer less from the drought than the untreated ones. This is probably the result of the beneficial effect of the phosphate on the development of the root system. This opportunity has been taken to impress on the planters of the localities concerned, by visual observation, the importance of phosphatic fertilizers.

Weed Killers

Several conclusive demonstrations have been made at the request of small planters in order to show the effect of weed killers now being used commercially for the destruction of some of the most noxious weeds. As a result of these demonstrations several planters have shown a willingness to buy the chemicals but they consider that the cost of the spraying apparatus is still too high for them. Co-operative Credit Societies might prove specially useful in this connection.

Fungicides

Propaganda has been made for the treatment of planting material with Aretan. The good results obtained in the demonstrations in this connection and the low cost of the treatment have contributed to the widespread adoption of this fungicide specially by planters cultivating five to ten acres or more.

Sugarcane Varieties

Six demonstration plots containing the new varieties M.165/38, M.63/39 and M.76/39 and planted in 1947 or earlier have been harvested during the crop. The results obtained from these plots are given in table II below

Locality				M. 134/32	M. 165/38	M. 63/39	M. 76/39	M. 112/34
Camp des Ambrevades	...			25.0	35.1	31.1	24.4	23.1
Solferino	...	...	...	38.3	—	45.0	38.4	35.2
Camp Fouquereaux	...			26.9	33.0	32.6	26.8	—
Mont Ida	...	...	...	22.9	25.8	29.9	20.4	—
Cluny	...	...	...	23.3	25.2	27.6	23.5	—
Escalier	...	...	...	37.1	39.0	35.8	31.9	25.5
Average	...	...	...	28.9	31.6	33.7	27.6	27.9
Difference with 134/32	...			—	+2.7	+4.8	-1.3	-1.0

As may be seen, the varieties M.165/38 and M.63/39 have outyielded the standard variety M.134/32. But due to the low sucrose content of these two varieties, as found by the large scale tests carried out by the other divisions of this department, these varieties have not been recommended to the small planters for propagation. Those who were anxious to plant these varieties in spite of the warning given to them were advised to consult their millers before doing so.

As in the case of the demonstration plots with treatments of Phosphatic Guano, the results of these demonstration plots could not be analysed statistically. It was not considered advisable to lay down other demonstration plots with new varieties before they have been approved by the Central Board for commercial cultivation.

Some planters of the Flacq district have been found to cultivate cane varieties not approved by law. Following a complaint from one of the millers of the district, a complete survey of small planters fields of the district has been made. The result of the survey has been submitted to the Registrar, Central Board.

Other Activities

In addition to their normal duties the Field Demonstrators have assisted the other officers of the Sugarcane Research Station whenever necessary.

Mr. M. Sooltongos has carried out all the sugarcane analyses of the Station throughout the crop. Messrs. G. Avise and J. Marot have helped in the harvesting of trials under the control of the other divisions.

The writer assisted the Geneticist, Mr. A. de Sornay, in carrying out the work of his division.

Conclusion

Although there has been an appreciable improvement in the cultural methods of the small planters during the year, much progress can still be achieved in this line by broadening the outlook of small planters.

The appointment of three new field demonstrators early in 1949 will certainly improve the efficiency of the service in enabling closer contact with a larger number of small planters.

G. MAZERY,
Senior Field Demonstrator.



